

Doctoral Program in Medical Microbiology and Antimicrobial Immunity

Mandatory subjects

Program Director: *Prof. Dr. Katalin Burián, head of department, full professor*

The main pathogenicity factors of bacterial and viral infections (Lead instructor: Prof. Dr. Katalin Burián; 28 hours/6 credits, semester 2 or 4)

Immune Response against Pathogens (Lead instructor: Prof. Dr. Katalin Burián; 28 hours/6 credits, semester 2 or 4)

Research Methods in Microbiological Research (Lead instructor: Prof. Dr. Katalin Burián; 28 hours/6 credits, semester 2 or 4)

Course description

Informing students on course requirements

Program: Full-time PhD program
Course: The main pathogenicity factors of bacterial and viral infections
Course code: IODI-MEDMI-01
Academic year/Semester: 2 nd or 4 th semester of the academic year
Educator and contact details (e-mail): Prof. Dr. Burián Katalin, burian.katalin@med.u-szeged.hu Dr. Megyeri Klára, megyeri.klara@med.u-szeged.hu Dr. Spengler Gabriella, spengler.gabriella@med.u-szeged.hu Dr. Virók Dezső, virok.dezso.peter@med.u-szeged.hu Dr. Varga-Bogdanov Anita varga-bogdanov.anita@med.u-szeged.hu Dr. Mosolygó Tímea, mosolygo.timea@med.u-szeged.hu
Type of course: lecture/ <u>seminar</u> /practice/laboratory
Weekly hours of the course: 2
Credit value of the course: 6
Type of examination: final exam at the end of semester, practice exam, other: <u>written test (5-scale report)</u>

Preliminary requirements (preliminary academic performance or completed course required to fulfill the purposes and requirements of the course): medical microbiology/ microbiology
Purpose of course: The aim of the course is to provide students with a comprehensive understanding of the fundamental mechanisms of bacterial and viral pathogenesis, the biological background of host–pathogen interactions, and the molecular and cellular processes involved in the development of infectious diseases.
Outcome requirements of the course (specific academic results to be established by the course): The student understands the fundamental mechanisms of bacterial and viral pathogenesis, including the main molecular and cellular processes involved in host–pathogen interactions. The student comprehends the role of various virulence factors in the development of infection, the adaptive strategies of pathogens, and the basic principles of the host immune response. The student is able to compare the infection strategies of bacterial and viral pathogens and interpret the similarities and differences that arise during pathogenesis. The student applies the acquired knowledge in clinical or research contexts to understand issues related to the prevention, diagnosis, and therapy of infectious diseases. The student can interpret the significance of modern diagnostic and molecular biological methods (e.g. PCR, sequencing, MALDI-TOF) in the investigation of infectious disease pathogenesis. The student is capable of independently evaluating and integrating scientific sources into the analysis of research and practical problems related to microbiological pathogenesis.
Topics: Mechanisms and roles of the cytotoxic effects of pathogenic microorganisms in infections Molecular mechanisms of cytokine induction by pathogenic microorganisms and their role in pathogenesis Secretion systems of bacteria The role of bacterial exotoxins in infections Viral latency Immunopathogenesis of Chlamydia infections Pathogenesis of diarrheal infections Diseases caused by picornaviruses Viral infections of the upper respiratory tract

The role of protein phosphorylation in the early stages of host–pathogen interactions Intracellular defense mechanisms against intracellular pathogens Possibilities for the prevention of bacterial infectious diseases Possibilities for the prevention of viral infectious diseases
Supporting methods to achieve learning outcomes: Ph.D. dissertations accepted so far within the program, as well as publications available through PubMed search.
Evaluation of the acquisition of expected learning outcomes: Participation in the seminar is compulsory. Two absences are allowed; if more than two sessions are missed, the absences must be justified with appropriate documentation. Course requirements: Active participation in seminar sessions is a prerequisite for completing the course. Examination form: The final assessment is a written test, graded on a five-point scale as follows: 90–100% – excellent (5) 80–89% – good (4) 70–79% – satisfactory (3) 60–69% – pass (2) 0–59% – fail (1)
Mandatory reading list: Ph.D. dissertations accepted so far within the program, as well as publications available through PubMed search
Recommended reading list: Bacterial Pathogenesis: A Molecular Approach — ISBN 13: 978-1-555-81940-8 (4th edition, 2019) Molecular and Cellular Biology of Viruses Phoebe Lostroh - ISBN 9781032732121 (2nd edition, 2024)

Course description

Informing students on course requirements

Program: Full-time PhD program
Course: Immune Response against Pathogens
Course code: IODI-MEDMI-02
Academic year/Semester: 2 nd or 4 th semester of the academic year

Educator and contact details (e-mail): Prof. Dr. Burián Katalin, burian.katalin@med.u-szeged.hu Dr. Megyeri Klára, megyeri.klara@med.u-szeged.hu Dr. Spengler Gabriella, spengler.gabriella@med.u-szeged.hu Dr. Virók Dezső, virok.dezso.peter@med.u-szeged.hu Dr. Varga-Bogdanov Anita varga-bogdanov.anita@med.u-szeged.hu Dr. Mosolygó Tímea, mosolygo.timea@med.u-szeged.hu
Type of course: lecture/ <u>seminar</u> /practice/laboratory
Weekly hours of the course: 2
Credit vale of the course: 6
Type of examination: final exam at the end of semester, practice exam, other: <u>written test (5-scale report)</u>
Preliminary requirements (preliminary academic performance or completed course required to fulfill the purposes and requirements of the course): medical microbiology/ microbiology, immunology
Purpose of course: The aim of the course is to provide students with a comprehensive understanding of the functioning of the body's defense system against various pathogens, and to enable them to understand the dynamic interactions between the immune system and pathogens.
Outcome requirements of the course (specific academic results to be established by the course): The student understands the fundamental mechanisms of the innate and adaptive immune systems and their roles in defense against various pathogens (bacteria, viruses, fungi, and parasites). The student comprehends the immune evasion and immunomodulatory strategies employed by pathogens and is able to interpret how these mechanisms influence the outcome of infections. The student can compare the characteristics of immune responses against different types of pathogens, with particular emphasis on the roles of cellular and humoral components, as well as the regulation of inflammatory and antiviral processes. The student understands the interactions between the immune response and pathogenesis, including the mechanisms of immune-mediated tissue damage and chronic infections. The student is able to apply immunological knowledge to the prevention, diagnosis, and understanding of immunotherapeutic approaches to infections (e.g., vaccination, monoclonal antibody therapy, immunomodulators).

The student is capable of critically evaluating and integrating scientific literature, and of formulating independent professional reasoning and analysis within the field of immune response and pathogenesis.

Topics:

Characteristics of the immune response against extracellular bacteria
Characteristics of the immune response against intracellular bacteria
Characteristics of the immune response against viruses
Characteristics of the immune response against fungi
Evasion mechanisms of extracellular and intracellular bacteria
Evasion mechanisms of viruses
Evasion mechanisms of fungi
Mechanism and role of cytokine storm in bacterial and viral infections
Influenza viruses and the immune response against them
Protective and pathological immune responses during Chlamydia infections
The role of defensins in protection against infections
Immune response in tuberculosis and its implications for therapy
The role of innate immune responses in urinary tract infections

Supporting methods to achieve learning outcomes:

Ph.D. dissertations accepted so far within the program, as well as publications available through PubMed search.

Evaluation of the acquisition of expected learning outcomes:

Participation in the seminar is compulsory.
Two absences are allowed; if more than two sessions are missed, the absences must be justified with appropriate documentation.
Course requirements:
Active participation in seminar sessions is a prerequisite for completing the course.
Examination form:
The final assessment is a written test, graded on a five-point scale as follows:
90–100% – excellent (5)
80–89% – good (4)
70–79% – satisfactory (3)
60–69% – pass (2)
0–59% – fail (1)

Mandatory reading list:

Ph.D. dissertations accepted so far within the program, as well as publications available through PubMed search

Recommended reading list:

Advances in Clinical Immunology, Medical Microbiology, COVID-19, and Big Data: Immunology, Microbiology, Biostatistics, and Big Data (Current Issues in Medicine, 2) by Raj Bawa (Editor)
Publisher : Jenny Stanford Publishing
Publication date : December 23, 2021
Edition : 1st
ISBN-10 : 9814877840

Course description

Informing students on course requirements

Program: Full-time PhD program
Course: Research Methods in Microbiological Studies
Course code: IODI-MEDMI-03
Academic year/Semester: 2 nd or 4 th semester of the academic year
Educator and contact details (e-mail): Prof. Dr. Burián Katalin, burian.katalin@med.u-szeged.hu Dr. Megyeri Klára, megyeri.klara@med.u-szeged.hu Dr. Spengler Gabriella, spengler.gabriella@med.u-szeged.hu Dr. Virók Dezső, virok.dezso.peter@med.u-szeged.hu Dr. Varga-Bogdanov Anita, varga-bogdanov.anita@med.u-szeged.hu Dr. Mosolygó Tímea, mosolygo.timea@med.u-szeged.hu
Type of course: <u>lecture/seminar/practice/laboratory</u>
Weekly hours of the course: 2
Credit value of the course: 6
Type of examination: final exam at the end of semester, practice exam, other: <u>written test (5-scale report)</u>
Preliminary requirements (preliminary academic performance or completed course required to fulfill the purposes and requirements of the course): medical microbiology/ microbiology
Purpose of course: The aim of the course is to provide students with a comprehensive understanding of the experimental and analytical methods used in modern microbiological research, as well as to enable them to understand the scientific principles, applications, and limitations of these methods
Outcome requirements of the course (specific academic results to be established by the course): The student understands the major methodological approaches applied in microbiological research, including classical cultivation, microscopic, serological, molecular, and bioinformatics techniques. The student is able to select and apply the most appropriate experimental procedures for a given research question and to interpret the data obtained from these experiments.

The student understands the principles of experimental design, recognizes the importance of repeatability, reproducibility, and data integrity, and is able to apply these principles in practice.

The student can critically evaluate scientific literature and data derived from microbiological studies, identifying methodological limitations and potential sources of error.

The student is capable of applying modern research tools and technologies (e.g. PCR) in various microbiological investigations.

The student understands and adheres to laboratory safety regulations and ethical standards during microbiological research.

Topics:

Traditional and novel methods for the identification of bacteria
Methods for the cultivation, identification, and quantification of viruses; techniques for investigating the cytopathic effects of viruses
Characterization of host–pathogen interactions based on gene expression studies
Methods for measuring intracellular bacterial growth
Investigation of the microbiome
Serological methods
Application of recombinant DNA technologies
Application of PCR in microbiological diagnostics
Quantitative and real-time PCR
Alternative molecular methods to circumvent PCR patents
Sequencing strategies
Approaches to studying bacterial efflux pumps
Methods for bacterial quorum sensing and biofilm analysis

Supporting methods to achieve learning outcomes:

Ph.D. dissertations accepted so far within the program, as well as publications available through PubMed search. Demonstration and partial performance of selected methods in the laboratory by the students.

Evaluation of the acquisition of expected learning outcomes:

Participation in the seminar is compulsory.

Two absences are allowed; if more than two sessions are missed, the absences must be justified with appropriate documentation.

Course requirements:

Active participation in seminar/practice sessions is a prerequisite for completing the course.

Examination form:

The final assessment is a written test, graded on a five-point scale as follows:

90–100% – excellent (5)

80–89% – good (4)

70–79% – satisfactory (3)

60–69% – pass (2)

0–59% – fail (1)

Mandatory reading list: Ph.D. dissertations accepted so far within the program, as well as publications available through PubMed search recommended by the lecturer.
Recommended reading list: Laboratory Methods in Microbiology and Molecular Biology (Richa Salwan & Vivek Sharma, 1st ed., 2023) — ISBN: 978-0-323-95078-7.